Draft for Review

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Division of Fish and Wildlife
Marine Fisheries

2007 Management Plan for the Crustacean Sector

Developed in association with the
Commercial fishing licensing provisions set forth in the
"Rules and Regulations Governing the Management of Marine Fisheries"

September 14, 2006

Rhode Island Crustacean Fishery Management Plan 2007

Introduction:

Rhode Island general law pertaining to commercial fishing licenses requires that the Director of DEM develop conservation and management plans in support of regulations that may restrict the issuance of licenses (RIGL 20-2.1-9(5)). Restrictions on commercial licenses were clearly contemplated by the Rhode Island General Assembly as a means to limit fishing effort and to rebuild depleted fishery resources (RIGL 20-2.1-2, 20-3.1-2 (4)). Such plans are to be developed with advice from the Rhode Island Marine Fisheries Council (RIGL 20-2.1-10) and shall focus on fishery resources with the greatest value to the state. The current DEM commercial licensing program recognizes three fishery sectors; crustaceans, finfish, and shellfish. The following is the plan for the crustacean sector with recommendations for licensing in 2007. Two crustacean sector license endorsements, lobster and crustaceans other than lobster (crabs) are offered by DEM and are considered here. This plan emphasizes American lobster in recognition of their great commercial and recreational value to Rhode Island citizens. The 2006 licensing plan recommended no new lobster licenses in view of the poor resource status and ongoing management activities designed to rebuild the lobster resource in the Rhode Island area.

American Lobster:

Stock Status and Rebuilding Potential- The lobster resource in Narragansett Bay and Rhode Island coastal waters was over exploited for many years (ASMFC 1996, 2000, Gibson 2000). A stock decline in 2002 prompted the Atlantic States Marine Fisheries Commission (ASMFC) to initiate remedial action in lobster management Area 2 which includes Rhode Island state waters. An ASMFC subcommittee of lobster biologists and stock assessment scientists was convened to examine the problem and in January of 2003, issued a report that recommended reducing lobster landings in area 2 by 73% (ASMFC 2003a). In February 2003, the ASMFC adopted an accelerated minimum gauge schedule for Area 2 by emergency action. Further, the board authorized development of addendum IV to the ASMFC lobster fishery management plan. It was adopted in the fall of 2003 with an implementation date of June 1, 2005. Important elements of addendum IV included increases in minimum legal size, increases in escape vent dimensions, and an effort control program. The initial effort control plan offered by industry was deemed inadequate and rejected by the ASMFC. Additional guidance to the Area 2 states from the ASMFC on effort control was provided at the August 2004 and May 2005 lobster management board meetings. A key requirement for a revised plan was that trap effort should be capped at or near current levels with the possibility of adjustments pending new stock assessment results. “At or near current level” was clarified to mean within 20-30% of 2003 trap deployments as recorded in industry logbooks. In response, industry and managers developed Addendum VII that employs a history based effort limitation approach along with provisions that allow for transfers of pots between businesses. Addendum VII was adopted by ASMFC at their November 2005 annual meeting. State regulations to implement addendum VII were developed and aired at public hearing on May 15th, 2006. The Rhode Island Marine Fisheries Council (RIMFC), an advisory body to DEM, considered the regulations and public comments at there June 5th, 2006 meeting. They recommended to the Director of DEM that the regulations be adopted.

Agency trawl surveys clearly document the abundance decline that triggered the ASMFC emergency action in Area 2. Rhode Island Division of Fish and Wildlife (RIDFW) surveys conducted in Narragansett Bay and Rhode Island coastal waters since 1979 show that local lobster abundance dropped from high levels in the mid-1990's to low levels in 2002-2003 (Figures 1). Although recent surveys have caught more lobster, abundance has not recovered to former levels. URI scientists have observed a similar pattern in lobster catches made by the Graduate School of Oceanography survey in state waters (Figure 2). Both Massachusetts and Connecticut have reported lobster declines to the east in Buzzards Bay and to the west in Long Island Sound. The decline in abundance of both sub-legal and legal lobster from 1997 to 2002 was preceded by a steep decline in the abundance of newly settled lobster from 1990 to 1996 (Figure 3). New settlers descend to the bottom from the plankton each summer having been hatched from eggs carried by females during the preceding year. These abundance patterns are consistent with the generally accepted time lag of 6-7 years between first settlement and attainment of adult size. The available data indicate that declining abundance at the youngest benthic stage began early in the decade before the 1996 North Cape oil spill and the 1997 outbreak of shell disease, reducing recruitment to the adult stock. It is not clear why settlement declined although it was coincident to over fishing that reduced stock reproductive potential (ASMFC 1996, 2000). A shortage of local egg production is unlikely the cause as trawl surveys and fishery sampling showed above average abundance of mature size lobster. Declining settlement was however correlated with a downturn in the North Atlantic Oscillation index (Figure 4). The NAO index measures the difference between barometric pressure in Iceland and the Azores (Drinkwater and Mountain 1997). A positive pressure differential is associated with strong westerly winds across the North Atlantic Ocean, a condition that could facilitate delivery of surface larval lobster from offshore to inshore areas. Katz et al. (1994) showed through analysis of ocean currents and larval swimming behavior that such a subsidy was possible. Climatic and oceanographic control over larval delivery and survival has also been hypothesized by Wahle et al. (2006) based on coherent settlement patterns on spatial scales as large as RI to ME. In addition to reduced settlement, shell disease, oil spills, and increasing predation by finfish have likely increased natural mortality rate and reduced the number of lobster surviving from settlement to legal size. The combined effects of reduced settlement and declining post-settlement survivorship have impacted the fishery, reducing recruitment, landings and catch per unit effort (CPUE) to low levels (Figure 5). It is worth noting that juvenile settlement improved to average levels in 1997-1999 (Figure 3). Given the time lag from settler to adult, the increases in legal abundance observed in 2004-2006 are not unexpected. On a cautious note, settlement from 2002-2005 was relatively low suggesting that a return to very high stock levels is unlikely in the foreseeable future.

The ASMFC lobster technical committee has updated the coast wide lobster stock assessment including evaluation of new models that can consider increased natural mortality rate. They have also revised their definitions of stock areas and made recommendations for new biological reference points. National and international stock assessment experts have completed a peer review. The ASMFC lobster management board at their November 2005 annual meeting accepted the assessment results and peer

review which have since been published for public information (ASMFC 2006a, 2006b). The new assessment showed that the southern New England stock of lobster, spanning the region from Cape Cod to New Jersey, is at low abundance and subject to excessive fishing mortality rates. The peer review panel concurred and summarized their findings by stating;

"It is the future that leads to the greatest peril for the lobster resource. It would only take a sequence of two or three years of poor recruitment to collapse any component of the lobster resource and the appearance of extremely low recruitments in recent times in some areas is a cause for concern if not alarm. Until the harvest strategy is revised to provide a buffer of mature adult spawners to cover the bad times, lobster fishery management is a time bomb waiting to explode, its fuse lit by recruitment failure."

In response to the assessment and peer review, the ASMFC lobster management board authorized development of a draft public information document (PID) that could lead to Amendment V of the interstate fishery management plan for lobster pending public comment and further board deliberations. A Rhode Island hearing on the PID is scheduled for September 19th, 2006.

The above cited assessment results and peer review comments pertain to a broader stock area than the Rhode Island marine waters under jurisdiction of the state. To support Rhode Island 2006 licensing recommendations as required under RIGL 20-2.1-9, the Gibson (2000) biomass dynamic model (BDM) assessment for lobster in Rhode Island was updated. This method is useful for assessing stocks for which age determination is difficult. In addition to estimating stock size and fishing mortality rates (F), a BDM estimates biological reference points based on maximum sustainable yield (MSY). Data required are a time series of fishery landings and a biomass index along with any auxiliary estimates of F or stock biomass to tune the model. Biomass dynamic models are a mass balance approach in which stock biomass in a new year is the sum of last year's biomass plus new production minus the catch removed (Hilborn and Walters 1992). New production is the net balance between additions from growth and recruitment and losses from natural causes. Application of the BDM to data for the Rhode Island inshore lobster fishery revealed that F has declined in recent years (Figure 6). Landings for 2006 are incomplete so the 2005 estimate of F is the most reliable and is below that associated with MSY. Fishery managers generally set a target F somewhat below the threshold F_{msy} as a precautionary measure in the face of scientific uncertainty. While over fishing occurred from 1998-2003 ($F > F_{msy}$), fishing mortality in 2005 was about 80% of $F_{msy.}$ Therefore, the resource is considered fully exploited and not now subject to over fishing. The recent decline in F for lobster in the Rhode Island area is encouraging and consistent with data showing that fishing effort is declining. Three independent data sets, pots fished as recorded in industry logbooks, pot-hauls estimated from landings and observer CPUE, and trap tags ordered by industry; show that effort is well below the high levels that occurred in 1999-2000 (Figure 7). The reduction in F is also consistent with a local v-notching program designed to replace lobsters lost in the 1996 North Cape oil spill. Large numbers of legal size female lobster have been rendered unmarketable by the program thereby reducing the F rate on female lobster. Stock biomass (B) is responding but

remains below that needed for MSY (Figure 8). A resource is considered over fished until B exceeds B_{msy}. Over fishing is distinguished from over fished in a temporal sense with the former representing current F rate at or above its MSY reference level while the latter represents past F rates that have lowered B below its MSY reference level.

Projections of stock size into the future indicate that the stock can rebuild to near the B_{msy} reference level in 3 years if F remains below F_{msy} (Figure 9). Industry attrition and the v-notching of females has clearly reduced fishing mortality from 2000 to 2005 so that biomass recovery is possible although an important caveat is the assumption of normal stock productivity. The ASMFC technical committee believes that natural mortality rate (M) has increased for lobster in the Rhode Island inshore area. BDM assessment runs incorporating a tripling of M from 1997-2005 in accordance with the outbreak of shell disease showed that larger F reductions than indicated above would be needed to rebuild the stock. Persistent high M may limit the amount of rebuilding that can occur and remains an important research topic.

Management Program- Lobsters are managed within state waters by the Rhode Island Department of Environmental Management (RIDEM) with advice from the Rhode Island Marine Fisheries Council and RIDFW. Regional management of the lobster resource is the responsibility of the ASMFC. Amendment 3 to the fishery management plan (ASMFC 1997) and associated addenda govern the interstate management program and peer reviewed coast wide stock assessments (ASMFC 2000, 2006a) provide information on lobster biology and resource status. The ASMFC management program is organized by lobster management area with Rhode Island state waters part of Area 2. RIDEM complies with the Area 2 plan through a set of management measures that includes minimum gauge and escape vent sizes, trap limits, and protection of egg-bearing females. Both state (RI-MA) and federal waters are included in Area 2 making cooperative management essential. The current plan for Area 2 initially required a reduction in trap deployment to 800 in addition to a set of gauge and escape vent size increases in order to rebuild egg production to the minimum F10% level. As noted above, these measures have been augmented with additional restrictions via the ASMFC plan addendum process. Notably, a transferability based effort reduction program is under development and is expected to reduce the amount of traps deployed by 2007. Addendum VII was released for public comment in August of 2005 and approved by the ASMFC lobster management board on October 31. Adjustments to the effort control program in response to the new coast wide lobster stock assessment may occur under Amendment 5.

Fishery Management Goals and Objectives -

Goal- The following goal is adapted from the coast wide goal of the Atlantic States Marine Fisheries Commission (ASMFC 1996).

> *Rhode Island will have a healthy American lobster resource and a fishery management regime, which provides for sustainable harvest, cooperative management by stakeholders, and appropriate opportunities for fishery participation.*

Objectives-

1. Maintain fishing mortality rates and brood stock abundance at levels, which minimize the risk of stock depletion and recruitment failure.
2. Extend size-age composition of the resource and increase yield per recruit in the fishery while maintaining harvest at a sustainable level.
3. Maintain existing social and cultural characteristics of the fishery wherever possible
4. Promote economic efficiency in harvesting and use of the resource
5. Provide for adaptive management that is responsive to unanticipated short-term events or circumstances.
6. Increase understanding of American lobster biology and improve data collection, stock assessment models, and relationships between harvesters and scientists.

Licensing Options and Recommendations-

Current Rhode Island lobstermen fishing in state waters must hold either a multipurpose or lobster principal effort license to fish at full effort levels as allowed for by existing state and ASMFC regulations. The licensing statutes require that the Director of DEM specify by rule the status of the lobster resource each year and the availability of new lobster licenses. A limited number of individuals were issued limited access, basic commercial fishing licenses in 2003. These licenses allowed for a 100-pot deployment rather than the 800 pot, full access deployment. No lobster licenses were recommended or issued by RIDEM for 2004-2006. Licensing renewal data for 2003-2006 show a similar level of attrition as the fishing effort data given above (Table 1). Between 2003 and 2006, there has been an 14% decline in the number of licenses applicable to lobster.

RI Marine Fishery Council Advice- the Industry Advisory Committee (IAC) of the RIMFC, required under RIGL 20-2.1-11, has met twice to formulate advice for the Council on licensing. At their August 22nd meeting, the IAC took no position on new lobster licenses for 2007 because of pending effort control regulations before the DEM. The RIMFC met on and recommend to the Director of DEM that ?

RIDFW Recommendations- It is clear from the above information that the regional lobster resource is over fished and has undergone a decline in abundance and fishery performance. The decline has imposed substantial economic hardship on industry that has responding with attrition. Recently, the local stock has shown signs of increase but biomass remains below that needed for MSY. The regional rebuilding effort undertaken by the ASMFC has not yet been completed. Additional restrictions will be placed on existing fishers in 2006-2007 via addendum VII and Amendment 5 to the interstate fishery management plan including a prohibition on issuance of new area 2 permits. This prohibition includes state lobster licenses and landing permits applicable to lobster. The finding of over fished resource status (biomass below B_{msy} level) is inconsistent with Rhode Island fishery conservation standard A of RIGL 20-2.1-9. In view of ASMFC compliance requirements and state law, it is recommended that no new lobster licenses be

issued for 2007. The state should continue to work with the RIMFC and ASMFC to further reduce fishing mortality and to rebuild the lobster resource throughout the region. Attrition is clearly occurring in the industry and contributing to reduced fishing effort. The state should act to neutralize latent effort so that it cannot activate as resource conditions improve. Future participation in area 2 will be based on historical performance and the state should review lobster licensing and make appropriate changes in preparation for limited access-historical performance. When stock status warrants and harvesting capacity matches resource productivity, exit-entry ratios for licenses could be developed in consultation with industry, the RIMFC, and the ASMFC.

Other Management Considerations-

Industry is working closely with the ASMFC and RIDFW to implement the effort control program approved by the management board. Continued agency/industry cooperation is needed as implementation of transferability and historic participation schemes proceeds throughout the region. These programs, although controversial in some quarters, provide the best long-term mechanism to reduce lobster fishing effort. Industry has also expressed support for a replacement for the North Cape v-notching program that ended in July of 2006. As noted above, this program has reduced fishing mortality rate on female lobsters locally and egg production by v-notched females is now a substantial component of egg production (Figure 10). Evaluation of this program in the context of achieving ASMFC stock rebuilding targets should occur. To that end, DEM strengthened v-notch protection by implementing a more restrictive v-notch definition on September 12, 2006. The intent was to increase the longevity of v-notched lobsters and encourage industry to practice voluntary notching. Finally, industry supports continuation of the un-vented trap survey begun in 2006 as the primary abundance-monitoring tool for lobster. Continued federal funding to Rhode Island is needed to continue this survey.

Other Crustaceans:

Stock Status- The commercial crab fishery in state waters is relatively small with landings of green, Jonah, rock, and blue crabs being made. Total Rhode Island landings of these species is currently about 2.3 million pounds and worth about 1.9 million dollars. However, only a small amount of this is taken from state waters. Landings of deep-sea red crabs are also made but these come strictly from federal waters and participation is limited by federal permit. The local cancer crab stock was assessed by RIDFW for the first time for this licensing cycle. Fishing mortality rate has recently approached the F_{msy} level (Figure 11) and should be monitored in the future. Biomass however was above the B_{msy} level so the Rock and Jonah crab resource is not considered over fished at this time (Figure 12). There is not sufficient data to assess other crab species in state waters at this time. The introduction of the Japanese shore crab (*Hemigrapsus sanguineus*) has been noted and may have as yet unknown consequences for other crab species.

The horseshoe crab, although not a true crab, is also harvested. Horseshoe crabs in Rhode Island were found to be over fished and at low abundance in the first RIDFW assessment

(Gibson and Olszewski 2001). A commercial quota system with additional seasonal harvest restrictions has been instituted and landings have been reduced. An update of the stock assessment shows that while fishing mortality rate has been reduced to below the F_{msy} reference point, stock abundance has not yet recovered toward B_{msy} (Figures 13 and 14).

Management Program- Horseshoe crabs and crustaceans other than lobster are managed in state waters by the Department of Environmental Management with advice from the Rhode Island Marine Fisheries Council. The Department uses minimum sizes, seasons, quotas, and possession limits to manage the state waters fishery. Compliance with an ASMFC management plan is required in the case of horseshoe crabs and is achieved with a commercial quota and permitting system.

Fishery Management and Licensing Recommendations- No changes are recommended to the management program for horseshoe crabs and crustaceans other than lobster. Crab landings and abundance are stable and no new restrictions are needed. The spawning period closures have greatly restricted the horseshoe crab fishery and reduced fishing mortality rates. No additional limits are needed at this time. New commercial licenses for these species need not be limited and can have harvest levels equal to current licensees.

Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 1996. A review of the population dynamics of American lobster in the northeast. Special Report No. 61 of the Atlantic States Marine Fisheries Commission.

Atlantic States Marine Fisheries Commission (ASMFC). 2000. American lobster stock assessment report for peer review. Stock assessment report No. 00-01 (Supplement) of the Atlantic States Marine Fisheries Commission. July 2000.

Atlantic States Marine Fisheries Commission (ASMFC). 2003a. Total allowable landings for area 2. Report of the ASMFC lobster modeling subcommittee, January 2003.

Atlantic States Marine Fisheries Commission (ASMFC). 2003b. Lobster conservation management area 2: goals and management measures. Report of the ASMFC lobster technical committee, July 2003.

Drinkwater, K.F. and D.G. Mountain. 1997. Climate and Oceanography. Pages 3-25 in J. Boreman, B.S. Nakashima, J.A. Wilson, and R.L. Kendall, editors. Northwest Atlantic groundfish: perspectives on a fishery collapse. American Fisheries Society, Bethesda Maryland.

Gibson, M.R. 2000. Alternative assessment and biological reference points for the Rhode Island inshore lobster stock with estimations of unfished stock size. Report to the Atlantic States Marine Fisheries Commission and lobster assessment peer review panel.

Gibson, M.R., and S. Olszewski. 2001. Stock Status of Horseshoe Crabs in Rhode Island in 2000 with Recommendations for Management. RI Division of Fish and Wildlife. Research Reference Document 01/01**.**

Hilborn, R., and C.J. Walters. 1992. Quantitative fisheries stock assessment choice, dynamics and uncertainty. Chapman and Hall, New York. 570 p.

Katz, C.H., J.S. Cobb, and M. Spaulding. 1994. Larval behavior, hydrodynamic transport, and potential offshore recruitment in the American lobster, *Homarus americanus*. Mar. Ecol. Prog. Ser. 103: 265-273.

Wahle, R., M. Gibson, R. Glenn, P. Lawton, D. Robichaud, J. Tremblay, and C. Wilson. 2006. New England Lobster Settlement Index: Update 2005 Climate Controls.

Table 1- Rhode Island Lobster License Issuance Data 2003-2006

License Type	2003	2004	2005	2006
Multipurpose Licenses	1191	1135	1075	1017
% lobster declared	0.213	0.213	0.221	0.222
MPL for Lobster w/800 pot	254	242	238	226
Principal Effort Lobster w/800 pot	61	56	52	46
Commerical Lobster w/100 pot	50	48	41	38
Total Effective Lobster Licenses	321	304	295	277

Fig.1- Lobster Abundance in the RIDFW Seasonal Trawl Survey in Narragansett Bay and RI Coastal Waters, 1979-2006

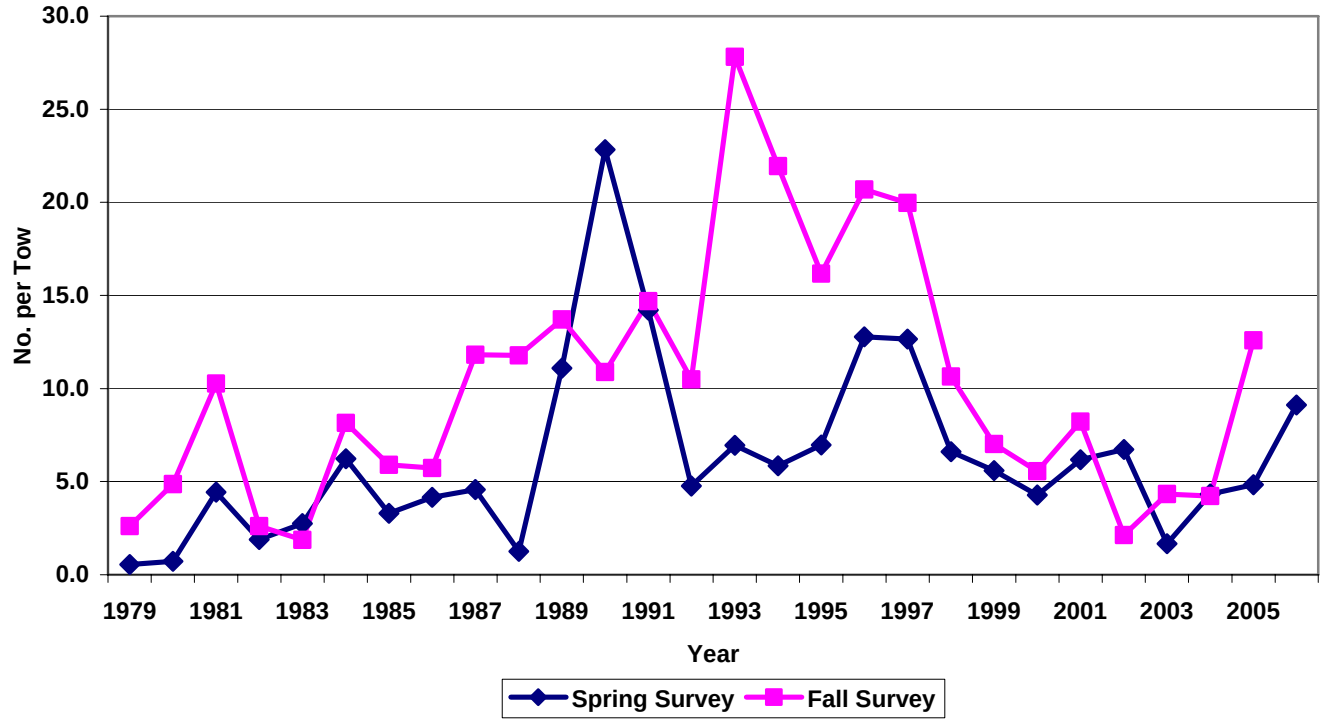

Fig.2- Lobster Abundance in the URIGSO Trawl Survey in Narragansett Bay, 1979-2006

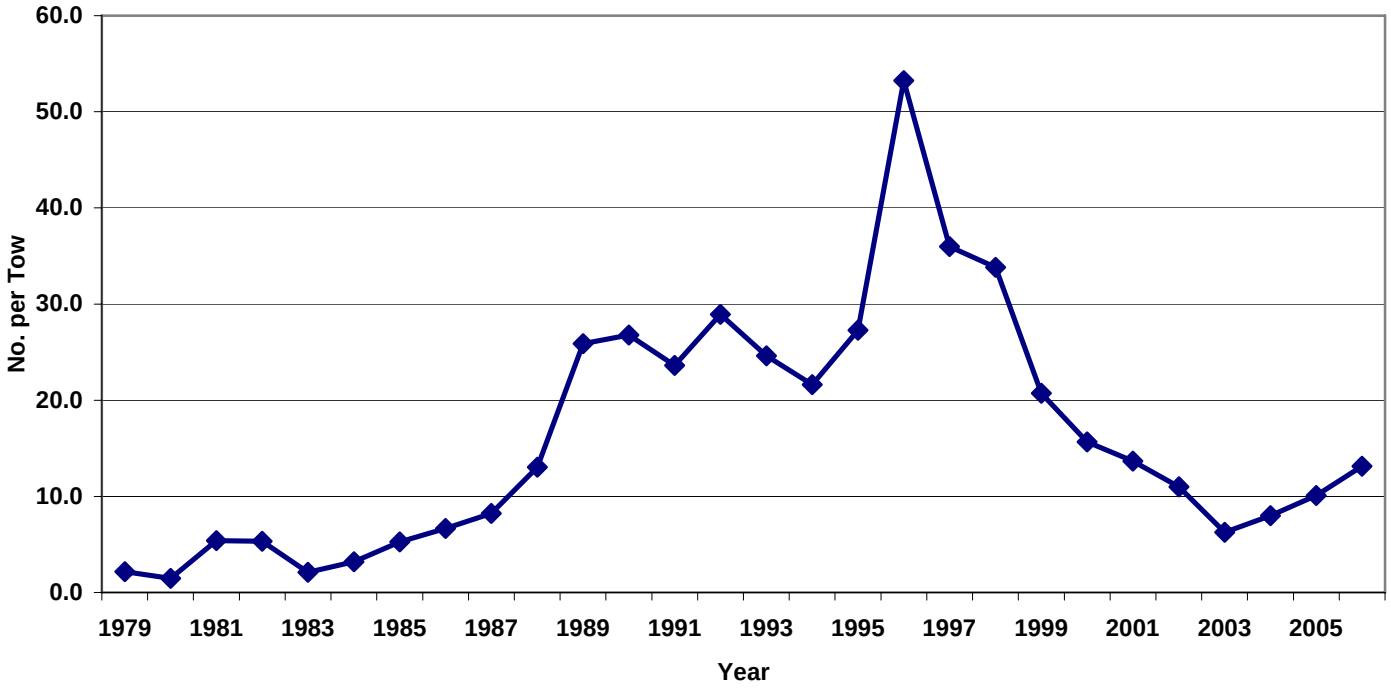

Fig. 3- Abundance of Newly Settled Lobster in Rhode Island from Wahle Dive Survey

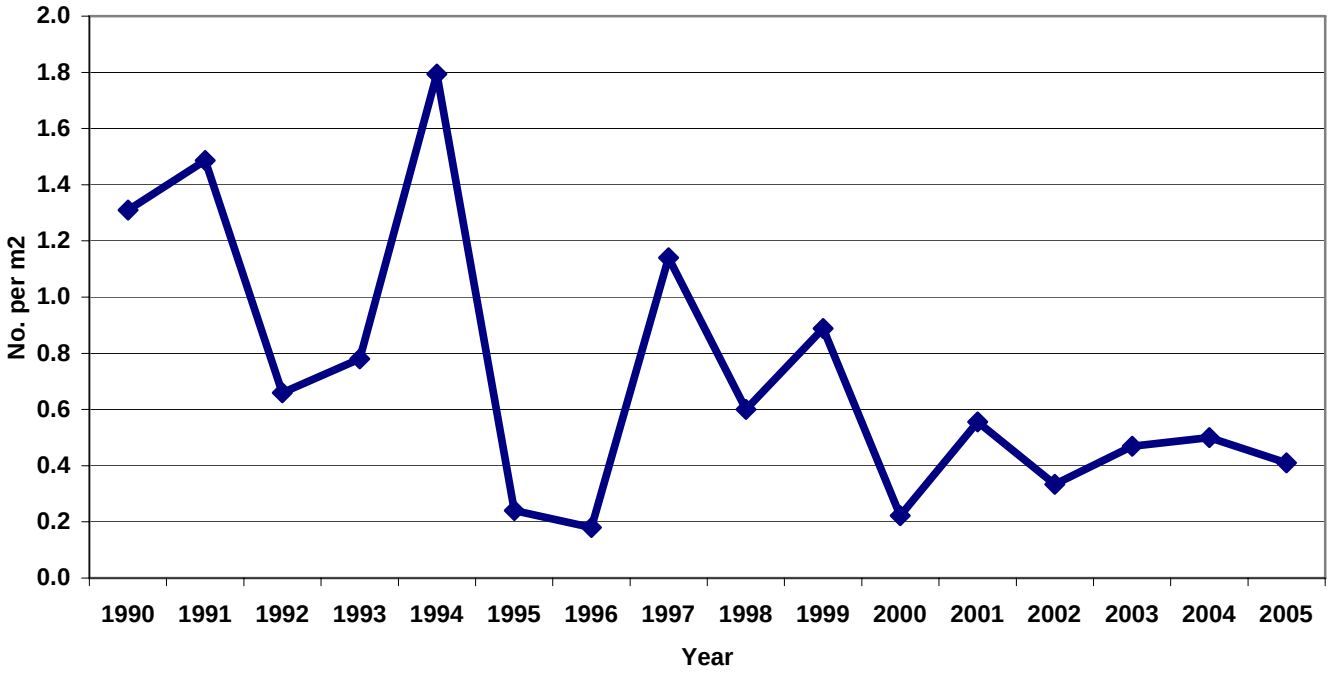

Fig.4- Correlation Between RI Lobster Settlement and Smoothed North Atlantic Oscillation Index

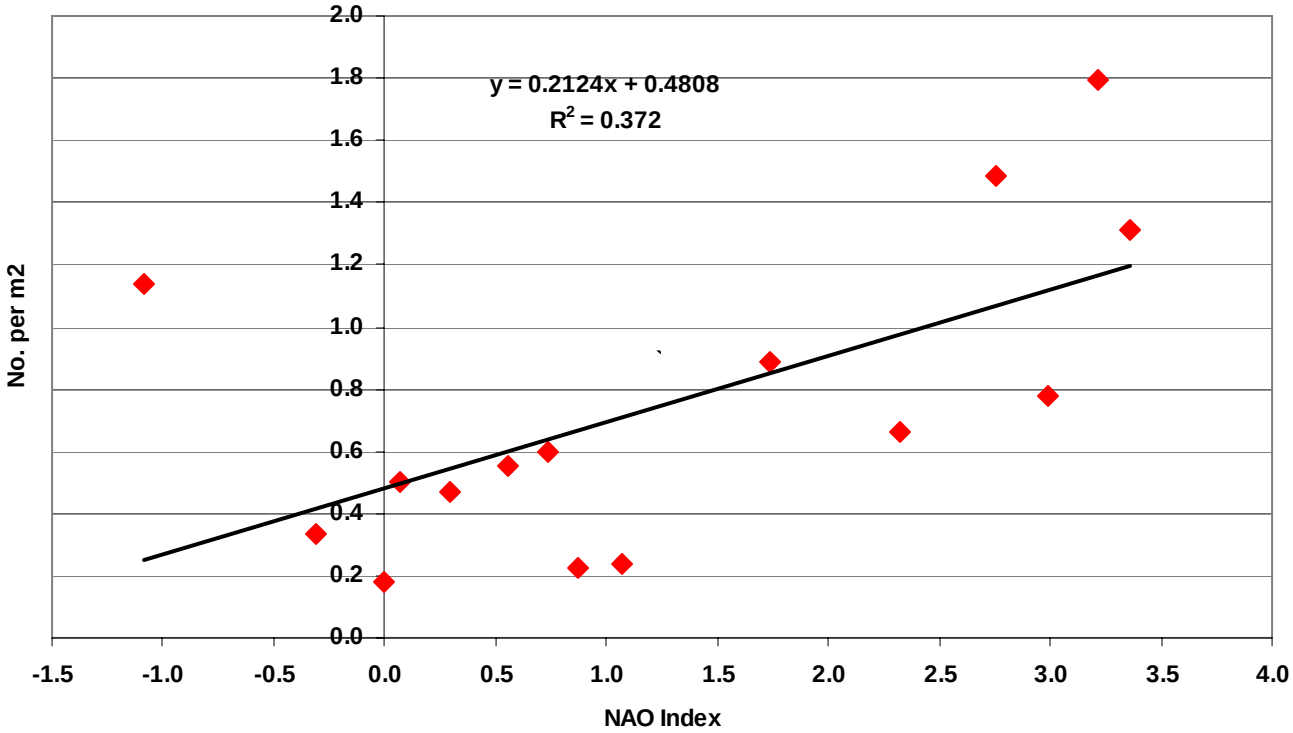

Figure 5- RI Inshore Lobster Landings and Fishery Catch per Unit Effort

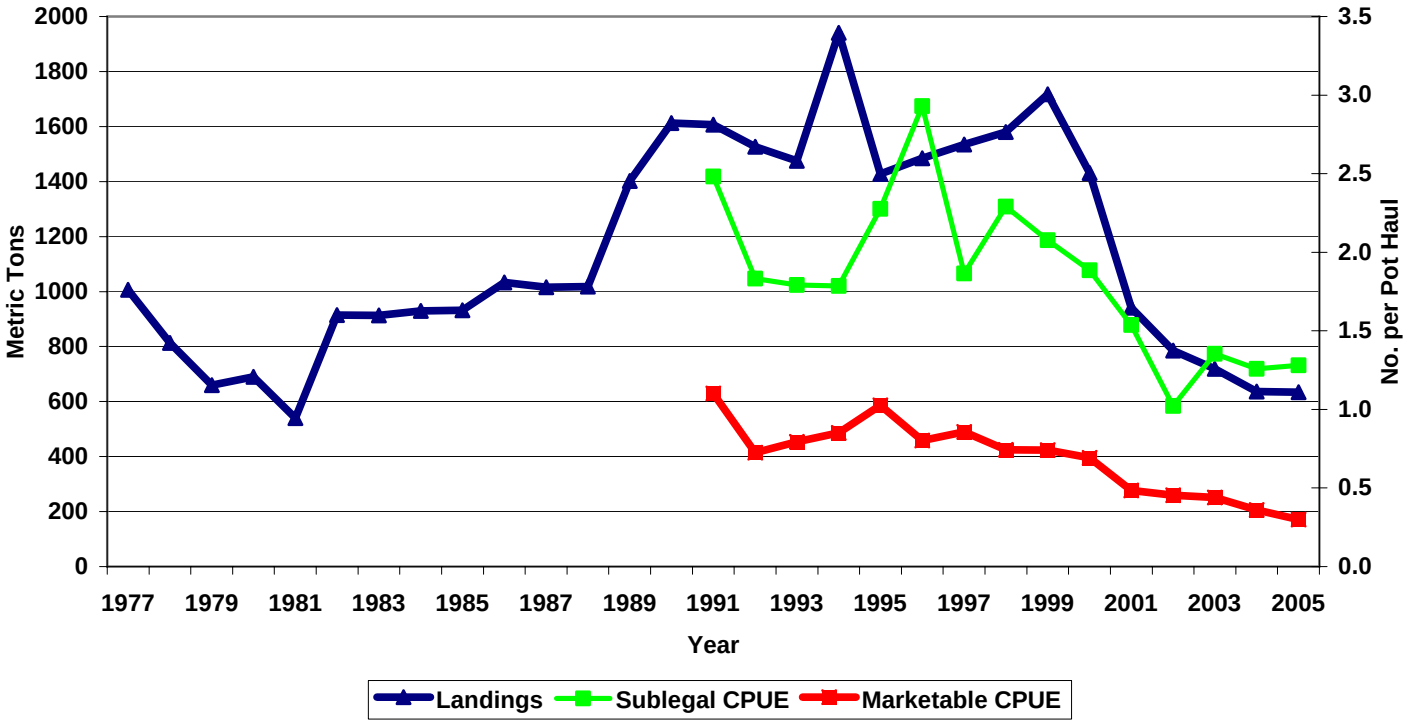

Fig.6- RI Inshore Lobster Fishing Mortality Rate from BDM Model Compared to MSY Level

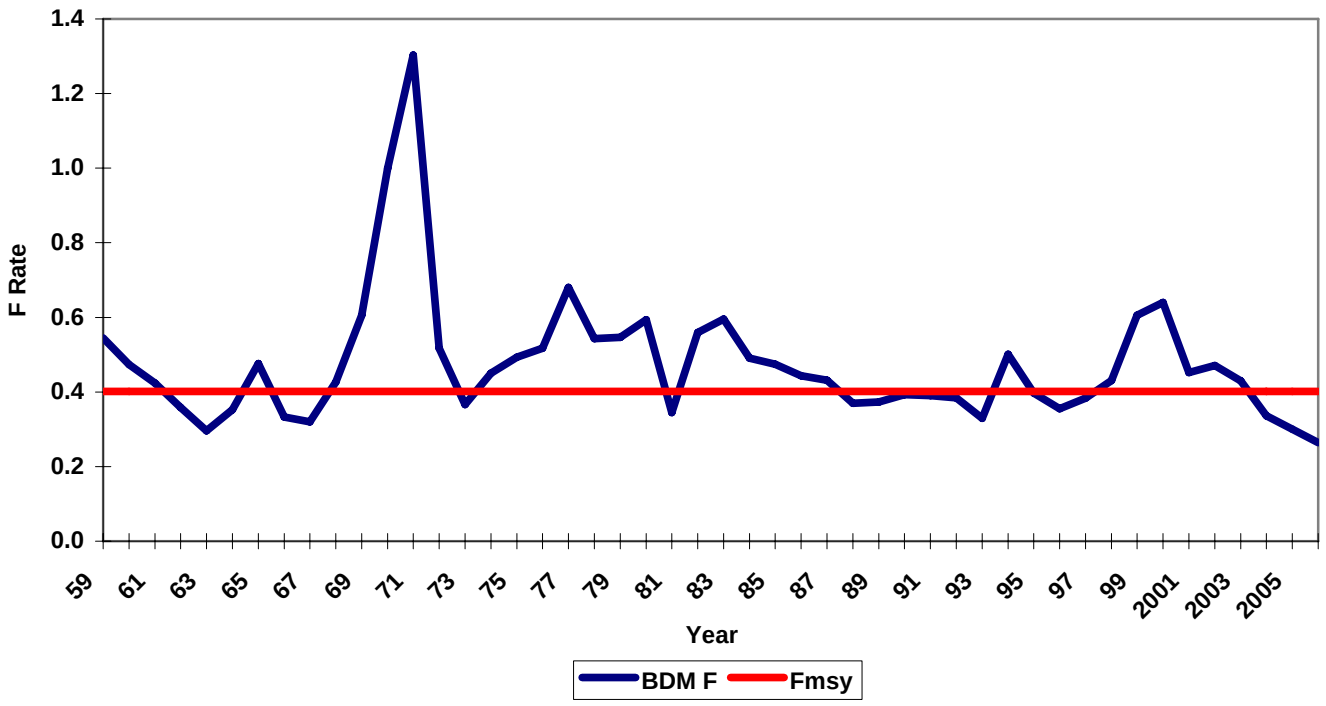

Fig. 7- Estimates of Fishing Effort in the RI Inshore Lobster Fishery

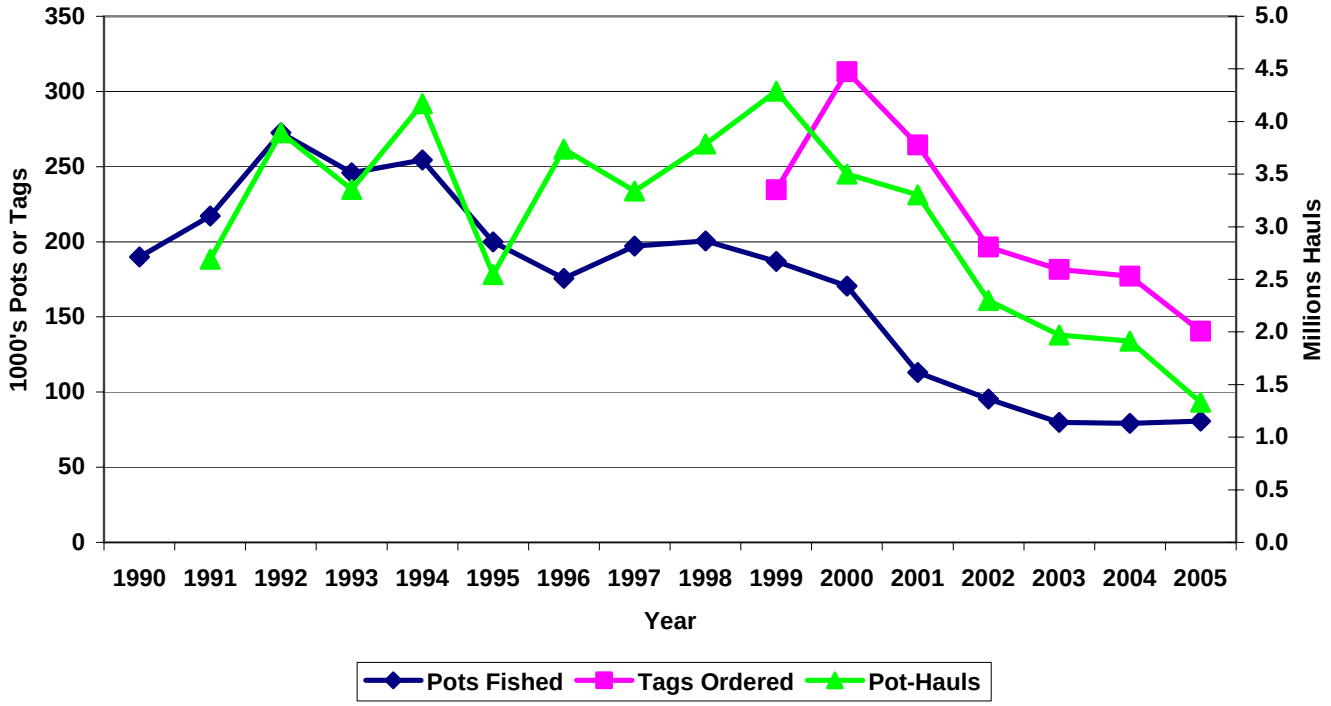

Fig.8- RI Inshore Lobster Absolute Abundance and Landings from BDM Model Compared to Bmsy

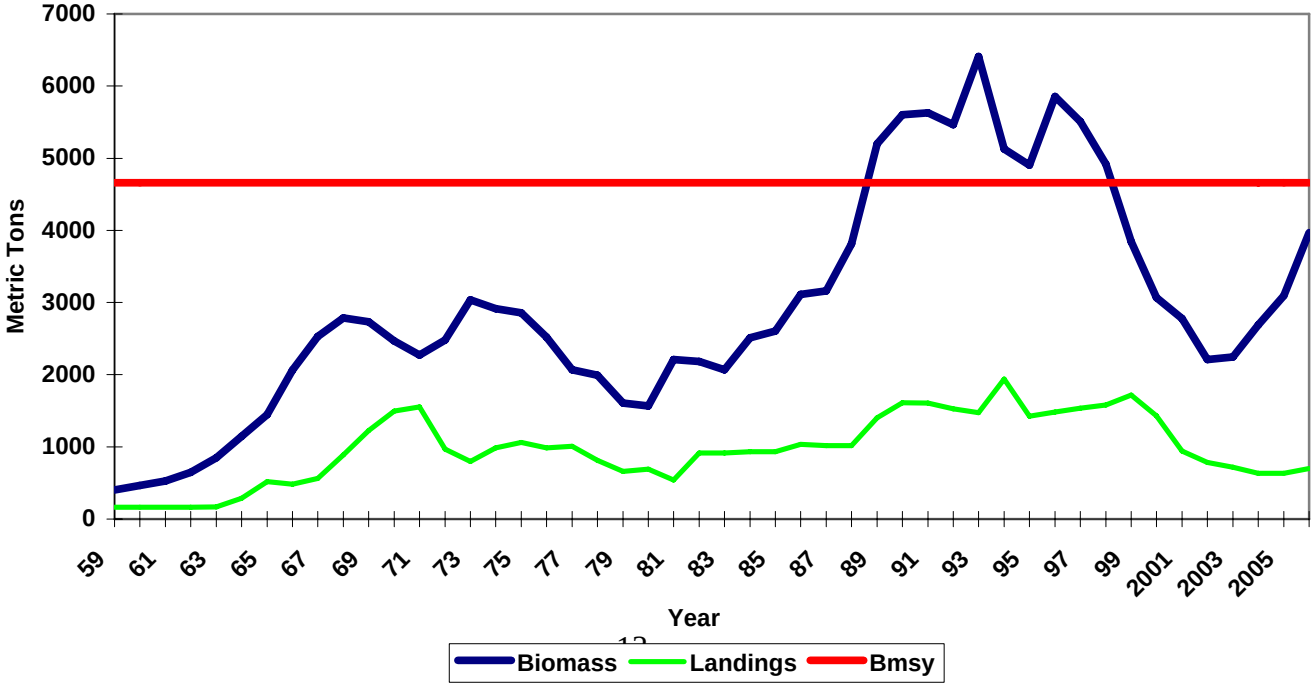

Fig.9- RI Inshore Lobster Stock Abundance and Landings Projection with Status Quo F in 2005. Assumes Normal Stock Productivity

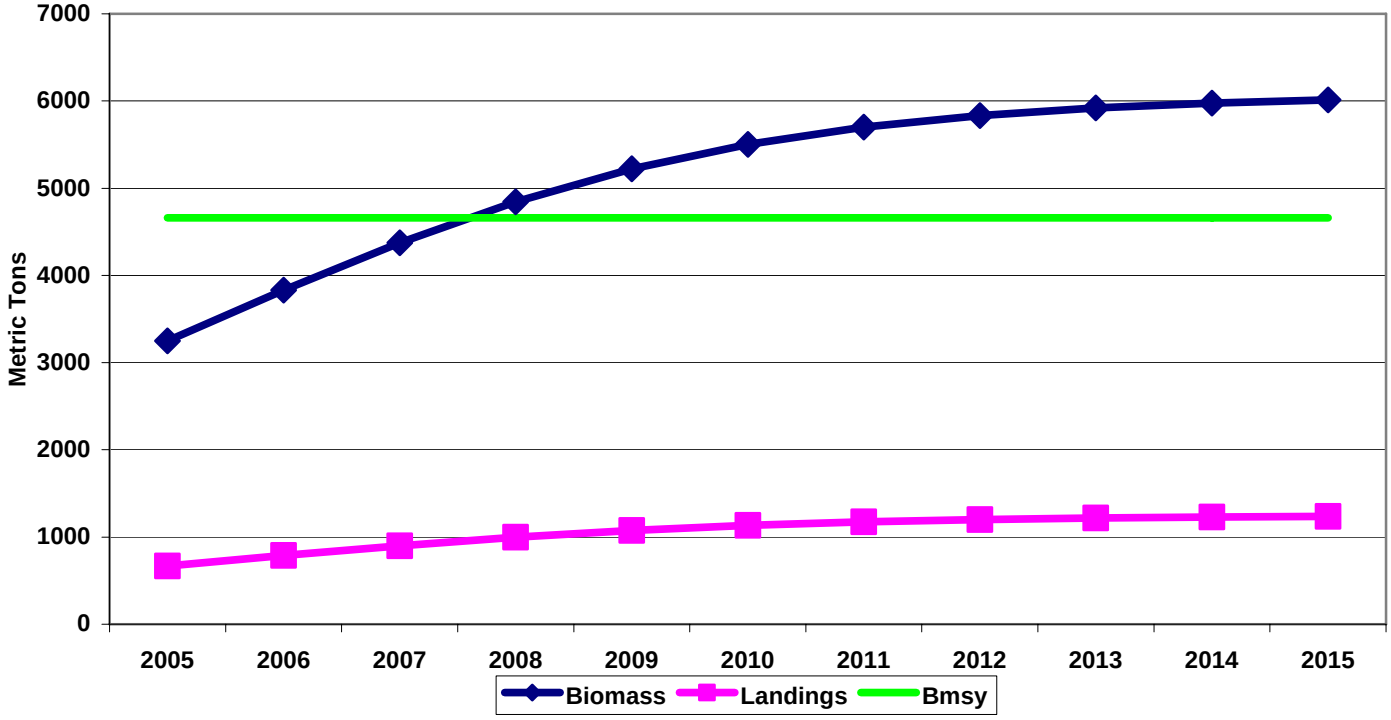

Fig.10- Proportion of Total Area 2 Eggs Carried by V-notch Females

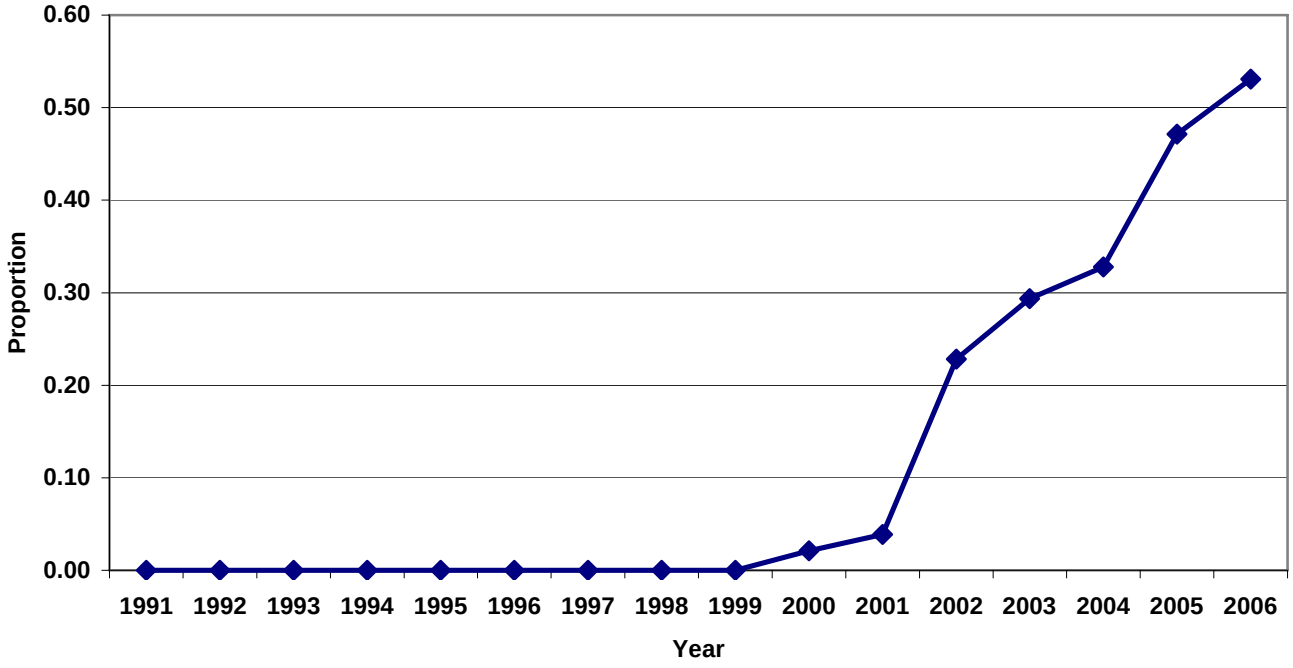

Fig-11- RI Cancer Crab Fishing Mortality Rate Compared to MSY Reference Level

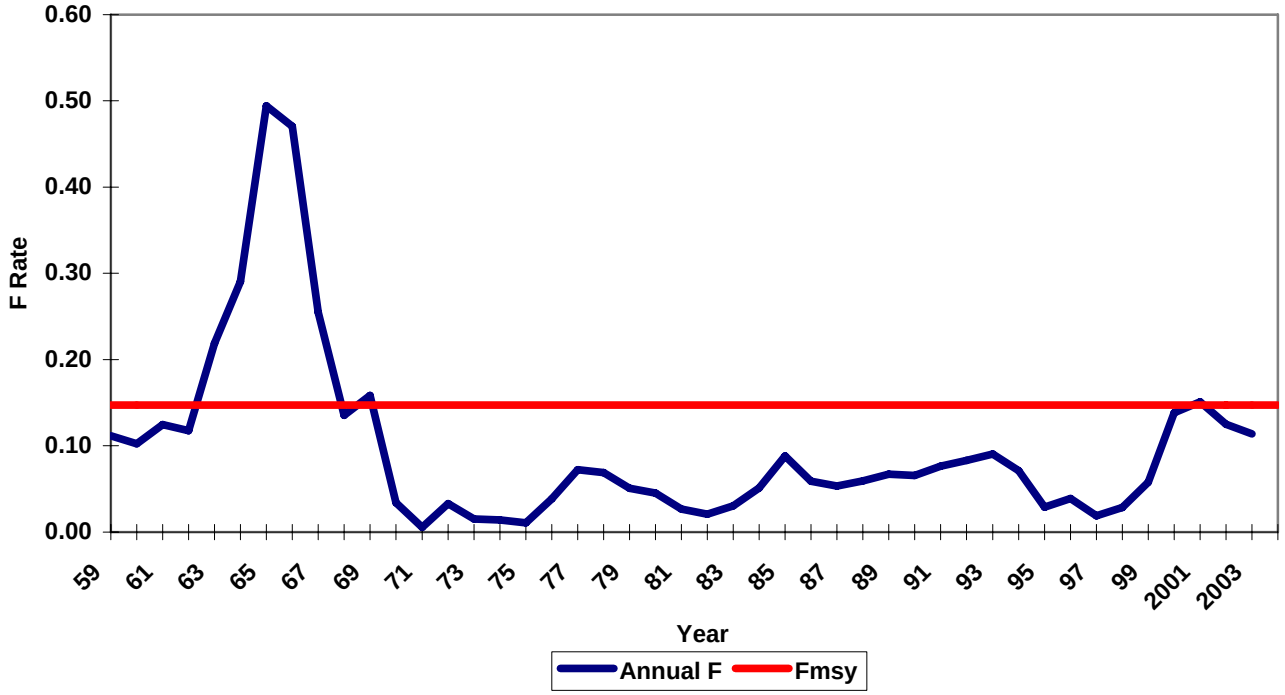

Fig.12- RI Cancer Crab Abundance and Landings Compared to MSY Reference Level

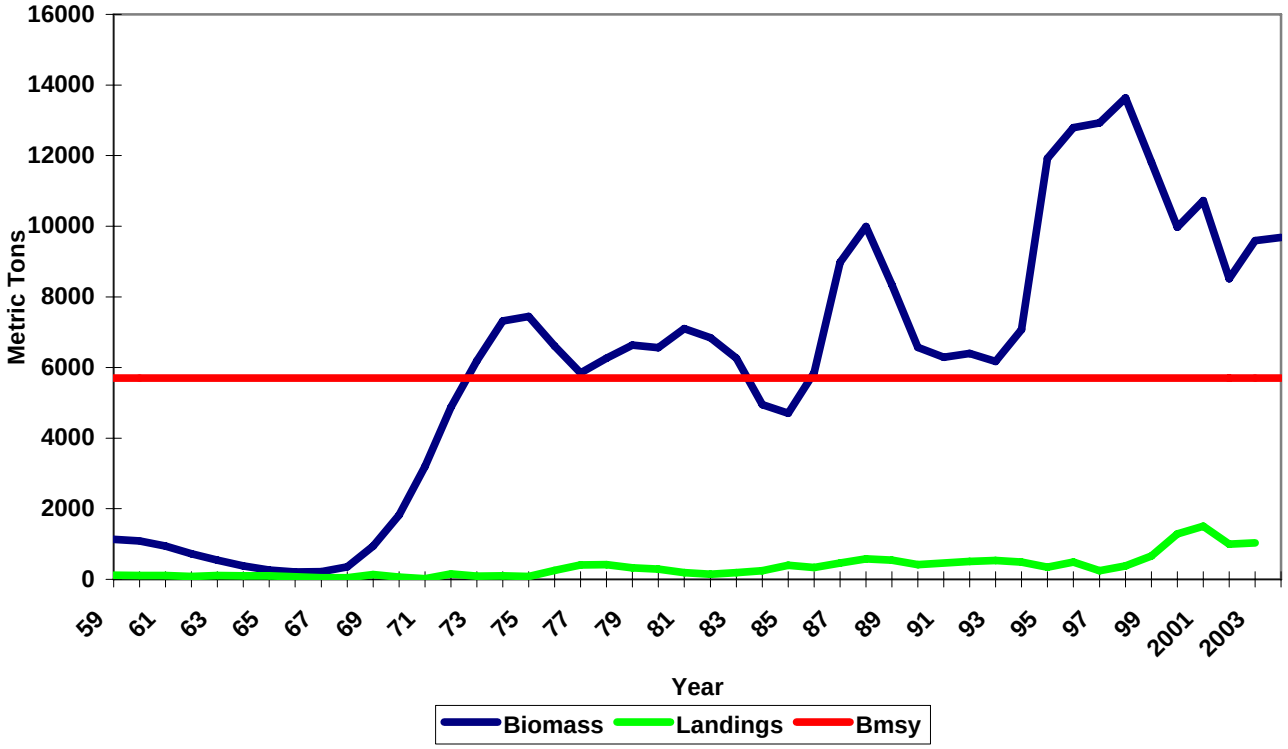

Fig.13- RI Horshoe Crab Abundance and Landings Compared to MSY Reference Level

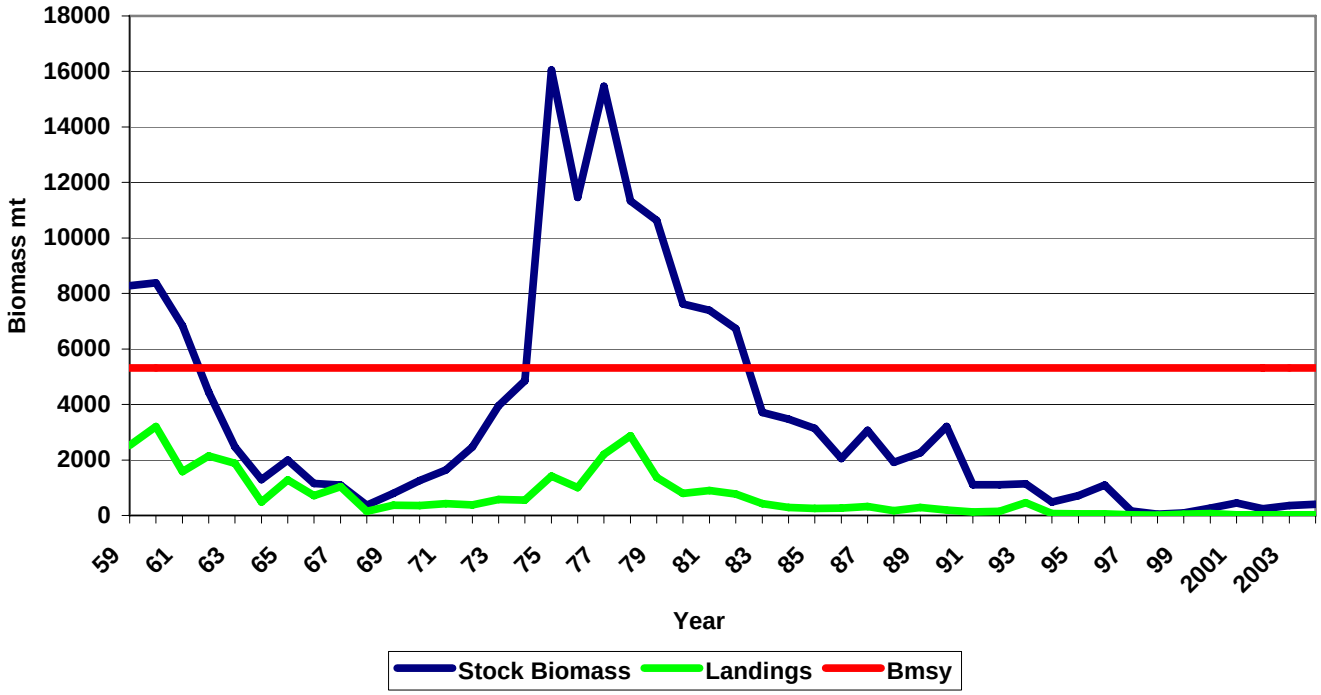

Fig.14- RI Horshoe Crab Fishing Mortality Rate Compared to MSY Reference Level